

Name _____ Period _____

Chapter 46: Animal Reproduction
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Concept 46.1 Both asexual and sexual reproduction occur in the animal kingdom

1. Distinguish between *sexual reproduction* and *asexual reproduction*.
2. Which form of reproduction:
 - a. relies entirely on *mitosis*
 - b. forms *gametes*
 - c. results in offspring genetically identical to the parent
 - d. produces a *zygote*
 - e. occurs in *budding*
 - f. is seen in *parthenogenesis*
3. Return to the list above, and define the terms that are in italics.
4. What advantage does sexual reproduction provide? In what type of an environment would it be favored?
5. For animals that are *sessile* (stationary), finding a mate presents a problem. What is one solution to this problem? Explain the origin of the term that describes this solution.
6. Here's an interesting concept—in some animals, the sex is not fixed but can change during the life span of an individual. Males can become female, and females can become male! What is a possible trigger for these sex changes?

Concept 46.2 Fertilization depends on mechanisms that bring together sperm and eggs of the same species

7. What conditions are always required for *external fertilization*?
8. An AP Review Question (not covered in this chapter; you will find the answer at the end of the Reading Guide): Life on land presents both plants and animals with problems related to moving sperm to egg. What plant groups have swimming sperm and require water for fertilization?
9. Now, how have animal species solved the problem of moving sperm to egg in a dry environment? And how have plants solved that same problem?
10. Consider the problems of fertilization and protection for the embryo. Compare these groups by filling in the blanks with the word *high* or *low*.

Group	# Eggs Produced	# Offspring Produced	Protection of the Embryo/Parental Care
Salmon			
Oysters			
Frogs			
Chicken			
Horse			

11. In populations that are stable in size, each mating pair of animals must produce a pair of offspring.

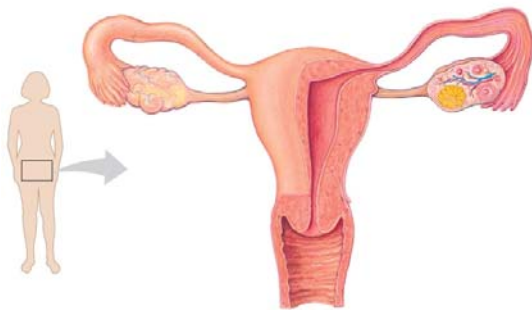
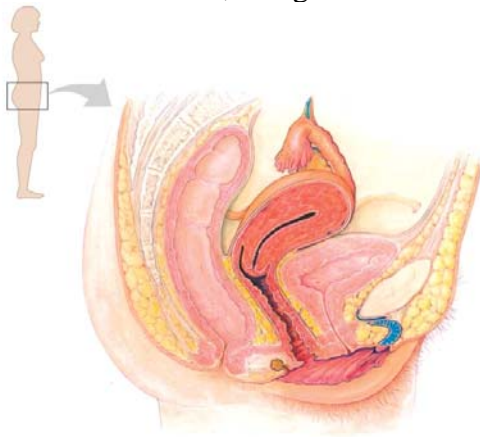
The purpose of the preceding exercise was to lead you to making the following generalizations:

Animals that have internal fertilization tend to produce _____ (many/few) offspring. Animals that have greater parental care tend to produce _____ (many/few) offspring. Animals that have external fertilization tend to produce _____ (many/few) eggs.

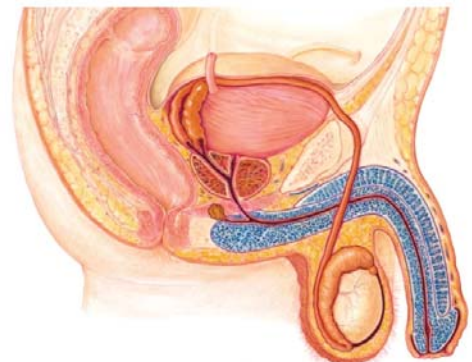
12. What are the *gonads*?

Concept 46.3 Reproductive organs produce and transport gametes

13. The female *gonads* are the *ovaries*. What are the male gonads?
14. Both male and female gonads have the same function: to produce the gametes and to produce the sex hormones. With that in mind, what is produced by the ovaries?
15. You need to know the correct anatomical name and function of the reproductive organs. Use these terms: *oviduct*, *ovary*, *uterus*, *labia*, *vagina*, *cervix*, *corpus luteum*, *follicle*, and *endometrium*, and give the function of each structure.



16. In a similar manner, you will need to know the structure and function of the male reproductive system. Label and describe the function of *vas deferens*, *seminal vesicle*, *prostate gland*, *bulbourethral gland*, *epididymis*, *testis*, *scrotum*, *penis*, *urethra*, and *urinary bladder*.

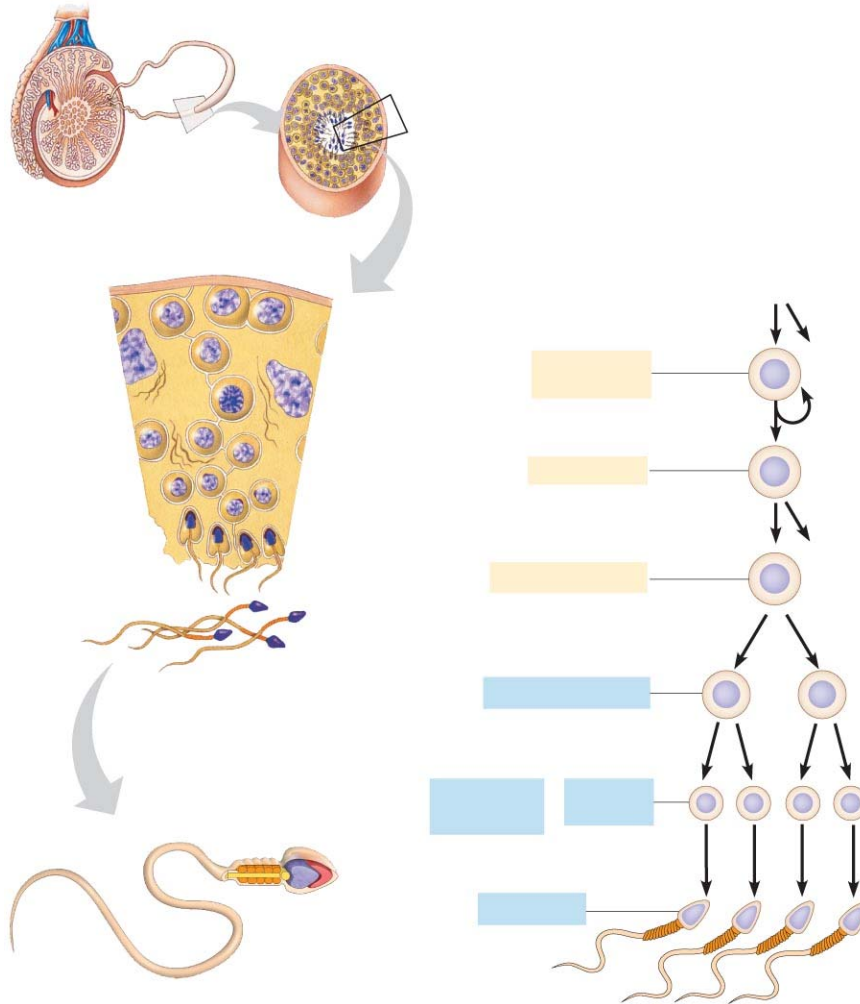


17. What three *accessory glands* produce the fluid part of semen?
18. Within the testes, where specifically are sperm formed?
19. What is produced in the *Leydig cells*?
20. Sperm are produced within the *seminiferous tubules*. List the structures, in order, through which sperm will pass before *ejaculation*.
 - a.
 - b.
 - c.
 - d.

Concept 46.4 The timing and pattern of meiosis in mammals differ for males and females

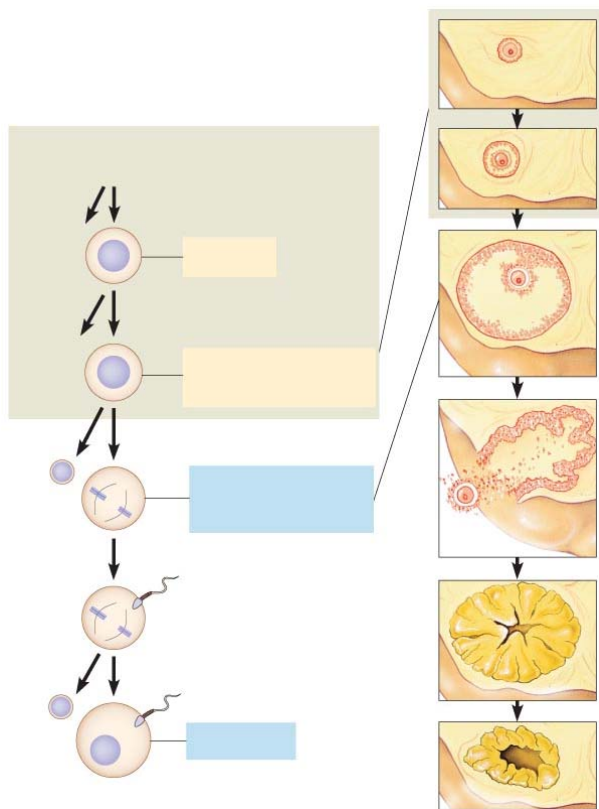
21. What is *gametogenesis* in males called?
22. What is *gametogenesis* in females called?
23. Study Figure 46.12, *Spermatogenesis*, carefully to answer the next group of questions. Which cells are constantly replenished by mitosis?
24. Some of the *spermatogonia* will differentiate to become the *primary spermatocytes*, which undergo meiosis. How many sperm cells are produced as a result of meiosis?
25. What is contained within the *acrosome*?
26. How long is the process of spermatogenesis in humans?

27. Label the figure of *spermatogenesis* to show the *seminiferous tubules*, *sperm acrosome*, *sperm flagellum*, *sperm mitochondria*, *spermatogonium*, *primary spermatocyte*, *secondary spermatocyte*, *meiosis I*, *meiosis II*, *spermatids*, and *sperm cells*. On each of the cells shown, indicate whether it is $2n$ or n .



28. Now, study Figure 46.12, *Oogenesis*. First note that the process of meiosis begins during embryonic development but is halted before birth. At what stage are all the “eggs” when a female is born?
29. What is a *follicle*?
30. When a female *ovulates*, what is released?
31. Your answer to question 30 should not have been the egg or an ovum! When is meiosis completed for the ovum?

32. When ovulation occurs, into what does the ruptured follicle develop?
33. Human males produce hundreds of millions of sperm *per day*! Do a rough count of the number of secondary oocytes a typical human female might produce in her lifetime. (See the end of this *Reading Guide* for a solution.)
34. Label the figure of *oogenesis* to show the *follicle*, *oogonium*, *primary oocyte*, *secondary oocyte*, *polar bodies*, *meiosis I*, *meiosis II*, *fertilized egg*, *mature follicle*, and *corpus luteum*. On each of the cells shown, indicate whether it is $2n$ or n .



35. What is a *polar body*?
36. If the first polar body divided, how many polar bodies could be formed in human female gametogenesis? How many eggs are formed?

Concept 46.5 The interplay of tropic and sex hormones regulates mammalian reproduction

In Chapter 45 you studied hormones, and now we are going to take a careful look at the hormones that control reproduction. While many students find this topic difficult, it will enable you to have a college-level understanding of human reproduction and therefore is important to master. Let's attack it systematically.

37. In males the hypothalamus secretes _____, which causes the anterior pituitary to produce two hormones, _____ and _____.

These are trophic hormones, and their target tissues are in the ovaries and testes. They will regulate gametogenesis, as well as cause the production of _____ in the testes and _____ in the ovaries. (All blanks in this question should be filled with the name of a hormone.)

38. What is the role of *FSH* in males?

39. What is the role of *LH* in males?

40. What is *menstruation*?

The female reproduction cycle involves changes in the uterus, and events in the ovaries, so we will need to look at both of these at once: the *ovarian cycle* and the *menstrual (uterine) cycle*. Since the control of menstruation is under hormonal control, we will begin at the hypothalamus.

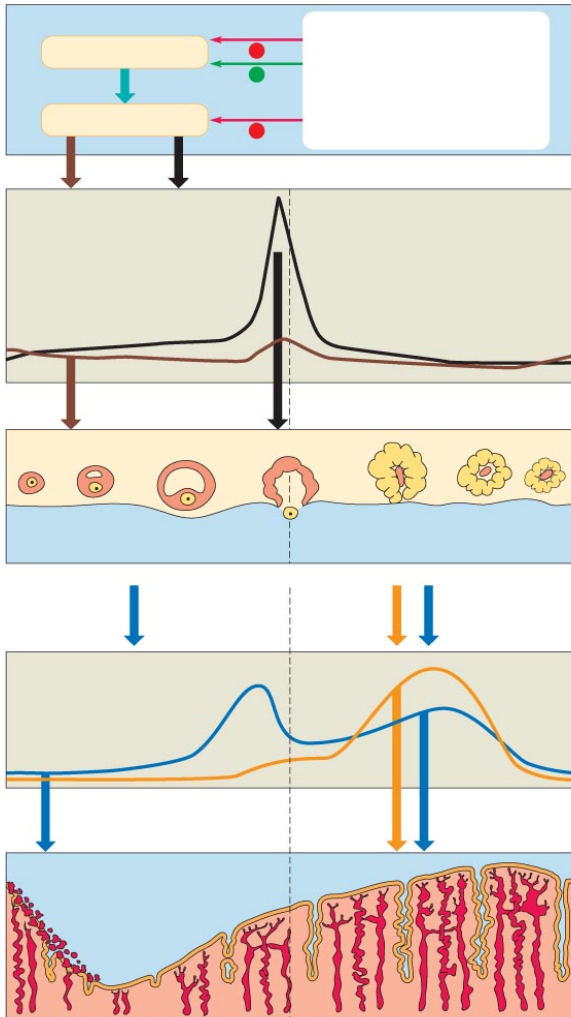
41. In females the hypothalamus secretes _____, which causes the anterior pituitary to produce two hormones, _____ and _____.

These are trophic hormones. The target of FSH is the ovarian follicles, and as FSH levels increase, follicles grow and oocytes mature.

42. FSH and LH get their names from events of the female reproductive cycle, but they also function in males. How are their functions in females and males similar?

43. Study Figure 46.14 carefully. There are two ovarian hormones: *estradiol* and *progesterone*. What hormone does the maturing follicle produce?
44. What does the LH surge trigger?
45. After ovulation, the follicle is transformed into a *corpus luteum*. What hormones does the *corpus luteum* produce?
46. How do high levels of progesterone and estradiol affect the uterine lining (*endometrium*)?
47. If fertilization does not occur, the corpus luteum disintegrates and the levels of both progesterone and estradiol drop. How do low levels of progesterone and estradiol affect the uterine lining?
48. Describe what occurs in each of these phases of the ovarian cycle:
- follicular phase**
 - luteal phase**
 - proliferative phase**
 - secretory phase**
 - menstrual flow phase**
49. By convention, what occurs on *day 1* of the menstrual cycle?

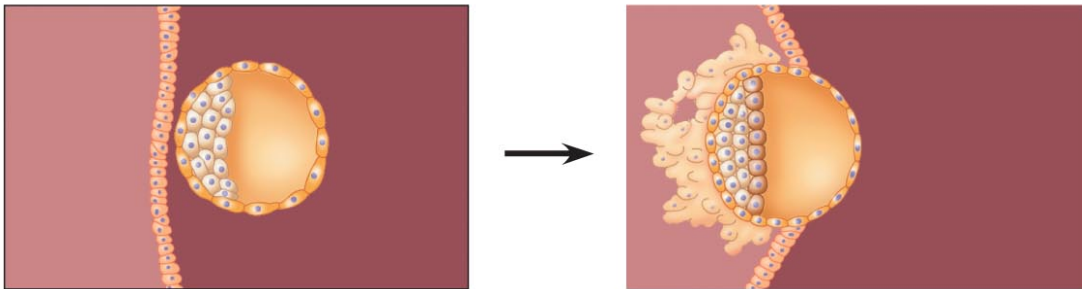
50. Can you put all this together? See how much of this figure you can now explain, and then refer to your text to complete the parts you need more help to answer.



Concept 46.6 *In placental mammals, an embryo develops fully within the mother's uterus*

51. What is the role of *HCG*? Is it produced by the embryo or by the mother?
52. How does a pregnancy test work?
53. The early embryo is called a *blastocyst*. What is the outer layer of the blastocyst called?

54. On the figure below, label *blastocyst*, *trophoblast*, and *inner cell mass*.



55. The *inner cell mass* will become the embryo. What will the *trophoblast* form?
56. What marks the transition from an *embryo* to a *fetus*? When does this occur?
57. What hormone stimulates uterine contractions?
58. Explain how each of these hormonal contraceptives prevents pregnancy, based on your understanding of the menstrual cycle.
- a. birth control pills/hormone skin patch or injection
 - b. progestin
59. Hormone-based contraceptives typically have pregnancy rates of 1% or less. What are their negative side effects?
60. In what ways are tubal ligation and vasectomy similar?

Testing Your Knowledge: Self-Quiz Answers

Now you should be ready to test your knowledge. Place your answers here:

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____

Solution to question 8: Mosses, liverworts and ferns all have flagellated sperm and require water for fertilization.

Solution to question 33:

If a female begins to menstruate at age 12 and continues to menstruate for 40 years, with an average of 12 cycles/year, she would ovulate approximately 480 times. This is only a rough estimate!